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| 09/206,027  | 12/04/1998  | BARNEY M. COHEN      | AMAT/3049/MD        | 4950             |
| 32588   | 7590        | 01/31/2005           | EXAMINER            |                  |
| APPLIED MATERIALS, INC.<br>2881 SCOTT BLVD. M/S 2061<br>SANTA CLARA, CA 95050 |             |                      | VINH, LAN           |                  |
|   |             |                      | ART UNIT            | PAPER NUMBER     |
|   |             |                      | 1765                |                  |

DATE MAILED: 01/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/206,027

**Applicant(s)**

COHEN ET AL.

**Examiner**

Lan Vinh

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 8-23,31-39 and 41-50 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 36-39 is/are allowed.
- 6) ☒ Claim(s) 8,9,11-14,16-23,31,32,35 and 41-50 is/are rejected.
- 7) ☒ Claim(s) 10,15,33 and 34 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

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### **DETAILED ACTION**

1. Applicant's arguments, see pages 11-12 of the response, filed 6/19/2003, with respect to the rejection(s) of claim(s) 4,8, 10-23, 26 under 35 U.S.C 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Van Cleemput et al (US 5,872,058) reference. A discussion of the rejection follows.

#### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 18, 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 18 and 21 are indefinite because they depend on canceled claim 1.

For the purpose of examination, claims 18, 21 are best understood as depending on claim 14.

#### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Konecni et al. (EP 0849 779 A2) in view of Van Cleemput et al (US 5,872,058)

Konecni discloses a process for forming a semiconductor structure using plasma etching comprising exposed a patterned substrate to a plasma generated from a gas mixture of argon, helium and hydrogen in a processing chamber/ a plasma generated from a gas mixture consisting of argon, helium and hydrogen ( col 3, lines 52-57; col 6, lines 40-47 and fig. 4 )

Unlike the instant claimed invention as per claim 8, Konecni does not specifically disclose the step of increasing the helium content of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises less that about 75% by volume of argon

However, Van Cleemput, in a process for filling gaps on substrate, discloses step of increasing the inert gas (helium) of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises about 13 % by volume of argon (col 2, lines 10-12, col 3, lines 35-38)

Since Konecni discloses that any suitable flow rates of gas can be used, it would have been obvious to modify Konecni method by increasing the inert gas (helium) of the plasma and using the gas mixture comprises less that about 13 % by volume of argon as per Van Cleemput because Van Cleemput teaches that etch rates are typically increased by increasing the flow rate of the inert gas (helium) (col 2, lines 9-10) and as the concentration of Ar decreases about 13% (fig. 8), the etch/dep ratio decreases , which corresponds to the overall deposition rate increasing (col 4, lines 49-52)

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5. Claims 8, 11-13, 22 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. ( US 5,534,445 ) in view of Van Cleemput et al (US 5,872,058)

Tran discloses a method for fabricating a thin film transistor. This method comprises the step of exposing a patterned substrate to a plasma generated by a gas mixture of hydrogen with inerts gases such as argon and helium/a gas mixture consisting of argon, helium and hydrogen ( col 4, lines 49-51 ).

Unlike the instant claimed invention as per claim 8, Tran does not disclose the step of increasing the helium content of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises less than about 75% by volume of argon

However, Van Cleemput, in a process for filling gaps on substrate, discloses step of increasing the inert gas (helium) of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises about 13 % by volume of argon (col 2, lines 10-12, col 3, lines 35-38)

It would have been obvious to modify Tran method by increasing the inert gas (helium) of the plasma and using the gas mixture comprises less than about 13 % by volume of argon as per Van Cleemput because Van Cleemput teaches that etch rates are typically increased by increasing the flow rate of the inert gas (helium) (col 2, lines 9-10) and as the concentration of Ar decreases about 13% (fig. 8), the etch/dep ratio decreases , which corresponds to the overall deposition rate increasing (col 4, lines 49-52)

Regarding claim 11, Tran discloses that the substrate surface comprises silicon oxide (col 4, lines 20-21 )

Regarding claim 12, Tran discloses that the plasma is derived by radio frequency supply ( col 4, lines 56-57 ) reads on the plasma is capacitively and inductively powered

Regarding claim 13, Tran discloses a pressure in the chamber at 180 mTorr ( col 5, lines 47-48 )

Regarding claim 22, Tran discloses delivering a radio frequency power in the range of 0.5-20 Watts (col 4, lines 47-48)

6. Claims 14, 16-21, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. (US 5,534,445) in view of Van Cleemput (US 5,872,058)

Tran discloses a method for fabricating a thin film transistor. This method comprises the step of exposing a patterned substrate to a plasma generated by a gas mixture of hydrogen with inerts gases such as argon and helium/a gas mixture consisting of argon, helium and hydrogen ( col 4, lines 49-51 ). Tran also discloses that the plasma is derived by radio frequency supply ( col 4, lines 56-57 ) which reads on the plasma is capacitively and inductively powered

Unlike the instant claimed invention as per claim 14, Tran does not disclose the step of increasing the helium content of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises less than about 75% by volume of argon

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However, Van Cleemput, in a process for filling gaps on substrate, discloses step of increasing the inert gas (helium) of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises about 20-70% by volume of argon (col 2, lines 10-12, col 3, lines 35-38, fig. 8)

It would have been obvious to modify Tran method by increasing the inert gas (helium) of the plasma and using the gas mixture comprises less than about 25-70 % by volume of argon as per Van Cleemput because Van Cleemput teaches that etch rates are typically increased by increasing the flow rate of the inert gas (helium) (col 2, lines 9-10) and as the concentration of Ar decreases about 13% (fig. 8), the etch/dep ratio decreases, which corresponds to the overall deposition rate increasing (col 4, lines 49-52)

Regarding claim 14, Tran discloses that the substrate surface comprises silicon oxide (col 4, lines 20-21)

Regarding claim 17, Tran discloses a pressure in the chamber at 180 mTorr ( col 5, lines 47-48 )

The limitations of claims 18-20 have been discussed above.

Regarding claims 21, 22, Tran discloses delivering a radio frequency power in the range of 0.5-20 Watts (col 4, lines 47-48)

7. Claims 31-32, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konecni et al. (EP 0849 779 A2) in view of Van Cleemput et al (US 5,872,058)

Konecni discloses a process for forming a semiconductor structure using plasma etching comprising exposed a patterned substrate at a vacuum pressure of  $10^7$ - $10^8$  Torr to a plasma generated from a gas mixture of argon, helium and hydrogen in a processing chamber at a power of 150-450 W ( overlaps the claimed range of between 300-450 Watts / a plasma generated from a gas mixture consisting of argon, helium and hydrogen at a power level between about 300-450 Watts ( col 3, lines 52-57; col 6, lines 40-47 and fig. 4 )

Unlike the instant claimed inventions as per claims 31, 35, Konecni does not specifically disclose the step of increasing the helium content of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises less than about 75% by volume of argon

However, Van Cleemput, in a process for filling gaps on substrate, discloses step of increasing the inert gas (helium) of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises about 13 % by volume of argon (col 2, lines 10-12, col 3, lines 35-38)

Since Konecni discloses that any suitable flow rates of gas can be used, it would have been obvious to modify Konecni method by increasing the inert gas (helium) of the plasma and using the gas mixture comprises less than about 13 % by volume of argon as per Van Cleemput because Van Cleemput teaches that etch rates are typically increased by increasing the flow rate of the inert gas (helium) (col 2, lines 9-10) and as the concentration of Ar decreases about 13% (fig. 8), the etch/dep ratio decreases , which corresponds to the overall deposition rate increasing (col 4, lines 49-52)



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Regarding claim 32, fig. 2 of Konecni shows a patterned substrate having a contact region/feature 36 having a depth greater than the width ( aspect ratio of the contact or feature ) reads on the patterned substrate comprise a feature having an aspect ratio greater than about 4 to 1.

8. Claims 41-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. ( US 5,534,445) in view of Van Cleemput et al (US 5,872,058)

Tran discloses a method for fabricating a thin film transistor. This method comprises the step of exposing a patterned substrate to a plasma generated by a gas mixture of hydrogen with inerts gases such as argon and helium/a gas mixture consisting of argon, helium and hydrogen ( col 4, lines 49-51 ).

Unlike the instant claimed invention as per claim 41, Tran does not disclose the step of decreasing the argon content of the plasma below about 75% by volume

However, Van Cleemput, in a process for filling gaps on substrate, discloses step of reducing argon concentration about 10-40 % by volume in the gas mixture (col 4, lines 49-50, fig. 8)

It would have been obvious to modify Tran method by reducing the Ar content as per Van Cleemput because Van Cleemput teaches that as the concentration of Ar decreases (fig. 8), the etch/dep ratio decreases, which corresponds to the overall deposition rate increasing (col 4, lines 49-52)

Regarding claim 43 Tran discloses delivering a radio frequency power in the range of 0.5-20 Watts (col 4, lines 47-48)

Regarding claim 44, Tran discloses that the substrate surface comprises silicon oxide (col 4, lines 20-21)

Regarding claim 45, Tran discloses that the plasma is derived by radio frequency supply ( col 4, lines 56-57 ) reads on the plasma is capacitively and inductively powered

Regarding claim 46, Tran discloses a pressure in the chamber at 180 mTorr ( col 5, lines 47-48 )

9. Claims 47-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. ( US 5,534,445) in view of Van Cleemput et al (US 5,872,058)

Tran discloses a method for fabricating a thin film transistor. This method comprises the steps of:

depositing an undoped polysilicon layer 16 (fig. 1), which reads on depositing a semiconductor sublayer, depositing a silicon oxide/dielectric layer 18 on the layer 16/sublayer, etching the layer 18/dielectric layer to expose a portion of the layer 16/sublayer (col 4, lines 30-31, fig. 1), exposing a patterned substrate to a plasma generated by a gas mixture of hydrogen with inerts gases such as argon and helium/a gas mixture consisting of argon, helium and hydrogen ( col 4, lines 49-51 ), depositing an aluminum layer/metal interconnect on the layer 18/dielectric layer (col 4, lines 33-38)

Unlike the instant claimed invention as per claim 47, Tran does not specifically disclose the step of increasing the helium content of the plasma and wherein the gas mixture comprises less than about 75% by volume of argon

However, Van Cleemput, in a process for filling gaps on substrate, discloses step of increasing the inert gas (helium) of the plasma to increase etching of the patterned substrate surface and wherein the gas mixture comprises less than about 75 % by volume of argon (col 2, lines 10-12, col 4, lines 49-50; fig. 8)

It would have been obvious to modify Tran method by increasing the inert gas (helium) of the plasma and using the gas mixture comprises less than about 75 % by volume of argon as per Van Cleemput because Van Cleemput teaches that etch rates are typically increased by increasing the flow rate of the inert gas (helium) (col 2, lines 9-10) and as the concentration of Ar decreases about 13% (fig. 8), the etch/dep ratio decreases, which corresponds to the overall deposition rate increasing (col 4, lines 49-52)

The limitations of claims 48-50 have been discussed above.

### ***Allowable Subject Matter***

10. Claims 10, 15, 33, 34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 36-39 allowed.

The following is a statement of reasons for the indication of allowable subject matter/ reasons for allowance:

Regarding claims 10, 15, 33, 34, 36, the prior art of record, taken either alone or in combination, fails to disclose or render obvious the specific gas concentrations, as

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required in claims 10, 15, 33, 34, 36, in combination with the rest of the limitations of claims 10, 15, 33, 34, 36

### ***Response to Arguments***

11. Applicant's arguments filed 6/19/2003 with respect to the Van Cleemput reference have been fully considered but they are not persuasive.

In response to applicant's argument that there is no suggestion to combine the references of Konecni/Tran with Van Cleemput because Van Cleemput is specific to an etch/dep using a gas mixture that is different from the claimed gas mixture, thus a combination of the references would suggest if anything to increase the flow rate of argon to increase etch using a gas mixture that includes silane and oxygen, the examiner recognizes that although Van Cleemput is specific to an etch/dep using a gas mixture that is different from the claimed gas mixture, the examiner also recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, since the motivation to combine the references comes from Van Cleemput (US 5,872,058) (Van Cleemput teaches the advantages of increasing the helium and decreasing the argon in an etching gas mixture as described above), one skilled in the art at the time the invention was made would have found it obvious to

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follow the teaching of Konecni/Tran and Van Cleemput to produce the claimed invention.

***Conclusion***

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAN VINH whose telephone number is 571 272-1471. The examiner can normally be reached on Monday-Friday 8:30 -6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



LV

January 12, 2005